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Dear Researcher,

Greetings!

Articles in this issue discusses about study endeavors to recent trends in textile industry.

We look forward many newer technologies in the next month.

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# ARTIFICIAL INTELLIGENCE- APPLICATION AND INNOVATIONS IN THE TEXTILE INDUSTRY

**Dr. M. RAJALAKSHMI**

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**ABSTRACT-** The automation and artificial intelligence is gradually making a backdoor entry in the textile industry and in the coming years more and more textile production centers will become smart factories Indian textile industry will have no choice but to catch up with the rest of the world by converting the production centers into smart factories in view of rising labour costs, increasing manufacturing and energy costs and wastages in the process. Only by riding on the wave of Textile 4.0, Indian manufacturing will become more competitive against major textile producing countries like China, Bangladesh and Srilanka. The Indian logistics sector is also rapidly adapting industry 4.0 and the supply chain of textile industry will get benefited due to the same in terms of proper production planning as well as fast movement of goods.

Keywords: Artificial intelligence, Automation, Textile industry

## I. Introduction

The textile industry is a labor-intensive industry, mainly based on manpower, which requires large investments. The process from the transformation of cotton into yarn and fabric, from the design of the outfit and its sale in the store, to the preparation of the new collection represents a great cycle. The most important criterion of this cycle is to make every stage of it measurable. Even in developed countries, the application of AI in textile technology is still not widely used. In Germany, the United States, and China, moreover, systems are being developed to address the complex problems predominant in their textile supply chain. However, in developed countries where production and quality control issues remain, prospective AI technologies may benefit the textile industry. The important thing here is to prepare our companies to embrace these innovations. If we want to create a future industry, we need to seriously examine things and work together to build our know-how and technology management skills.

Artificial intelligence (AI) explained Intelligence, the capability to acquire knowledge and apply them as skills, has been the sole supremacy of human beings. Intelligence can be characterized by the capacity for logic, understanding, self-awareness, learning, emotional knowledge, reasoning, planning. creativity, critical thinking, and problem-solving. If this ability can be produced artificially, it may be termed artificial intelligence or AI in short. This is what happened, and today, AI is one of the most influential breakthrough inventions in the scientific world [1].

## II. Concept of AI in the Textile Industry

The application of AI technologies in the textile industry is becoming visible as solving complex problems quickly and accurately is becoming key to competitiveness. The textile industry is a labor- intensive industry where many operations, including production and quality control, are predominantly handled by human hands. With AI innovation, attempts are made to develop technologies to improve efficiency and effectiveness in such operations. The concept of AI technology is based on basic actions like detection, identification, inspection, grading, machine vision, prediction, etc. All these actions are primarily done by humans, often considered tedious and often with ambiguous outcomes. AI can augment these basic actions' efficiency and accuracy with technologies categorized as expert systems, artificial neural networks, fuzzy logic, algorithms, and natural language.

## III. AI in Clothing Production Process

The clothing production process has been starts from the conceptualization phase, passes through design development, manufacturing, supply chain, and retailing till it reaches to the consumers. In the conceptualization stage a designer conceptualizes a theme based on the forecasting of trends in the color, fabrics, silhouette, and trims.

Once the design development has been finalized, the garment production process starts. The garment production process involves fabric spreading, cutting, bundling, sewing, pressing, inspection, and packing. Fabric is the major component of a garment and it is the input material for many garment manufacturing industries. Once the fabric is received, the quality is inspected, stored for some time, and then fabric is spread for cutting. Depending on the garment design, several components are cut using various cutting equipment. The cut components are bundled and fixed with a bundle ticket, which is then passed to the sewing floor.

The garment components are sewn by skilled operators, pressed and the finished garments are inspected for quality. Then the garments are packed and sent to the retailers by own or third party logistics providers. The retail point is the place where the consumers buy their product.

Today's consumers are much conscious on garment style, fit, quality, and price. Majority of these parameters are governed during the production steps. Hence, during these processes, various tasks are needed to be controlled by the managing staffs, which may be difficult in several instances. The use of AI can help to control these problems effectively for decision making, cut order planning, marker making, production planning, supply chain management (SCM), and retailing.

Apparel manufacturers have to produce a diverse product mix as consumers are difficult to understand and predict. Their choice is unstable and unpredictable, and there is a wide variation in their demographics and physiographic. The product quality depends on several factors related to yarn manufacturing, fabric preparation (weaving and knitting), fabric chemical processing, and garment manufacturing. Hence, all these factors can be better controlled by the application of AI in the whole process of apparel manufacturing. Although there is some automation, the apparel industries are still far behind the other sectors and rely on manual intervention.

AI is gaining impetus over the last two decades, in the apparel industry in different areas. The automation of various instruments by the application of AI in spreading, cutting, sewing, and material handling can reduce the production cost and minimize faults. The production of textiles and clothing involves a large number of variables relating to the material and process. As there is high variability in raw materials in addition to the multiple stages of operation, it is

hard to precisely control the process parameters to achieve a desired output.

Until now, establishing a proper relationship between these variables and the properties of a fabric depends on human expertise. In many instances there are chances of error involved with human working as it is a difficult task to always remember such a large number of variables and apply the knowledge for accurate property prediction. This is possible by the application of AI as the developments in computation and simulation have created various systems to deal with multiple variables (2-4). The application of AI can now deal with a large range of datasets during training to establish an effective relationship between the variables and the product properties. Therefore, over the last decade, the use of AI is rapidly growing in textile and clothing manufacturing industries for various applications.

#### **IV. Applications of Artificial Intelligence in Garment Industry**

AI can be used in various processes of textile production such as fiber grading, prediction of yarn properties, fabric fault analysis, and dye recipe prediction. Similarly, AI can be applied in all the stages (preproduction, production, and postproduction) of garment manufacturing. Garment manufacturing involves processes such as conceptualization, design development, PPC, spreading, cutting, bundling, sewing, pressing, and packaging [3]. Some of the major applications of AI in textile and garment manufacturing are discussed in this section. Out of several types of AI as discussed above, ANN (artificial neural network) is widely used in garment manufacturing mainly in following fields: Prediction of mechanical properties, Classification and grading, Identification and analysis of faults, Process control and online monitoring and SCM and retailing.

The following section describes the application of AI in various production processes involved with garment manufacturing.

#### **V. Application of Artificial Intelligence in Fiber and Yarn Production**

Textile fibers are the basic raw material for the production of clothing and other textiles. As there are many different types of textile fibers, it is often difficult to identify an unknown fiber by visual inspection. The traditional practices of fiber identification are based on destructive tests using flame or chemicals.

The recent advancements include the use of optical microscope, Fourier transform infrared and Raman spectroscopy [3]. AI can also be used to identify and grade textile fibers according to their

color and other properties such as fineness, length, uniformity ratio, tenacity and effect of spinning performance on yarn properties. There have been several applications of AI in yarn manufacturing that includes virtual modeling of yarn from fiber properties, prediction of yarn tensile properties, prediction of yarn unevenness and yarn engineering.

## **VI. Application of Artificial Intelligence in Fabric Production**

The major raw material for a clothing industry is fabric. The quality of the fabric influences the quality of the garment, productivity, and the ease with which garments can be manufactured. The fabrics are selected based on the type of the garment and their end use applications. The fabric specifications for making any garment can be classified as primary and secondary. The physical dimensions are considered to be the primary, whereas the fabric reaction to external forces is considered to be the secondary [4]. From consumer perspective, garment appearance, comfort, and durability are the important parameters. AI can be applied to control these parameters:

### **VII. Predicting Fabric Properties**

AI can be used to predict the fabric properties before manufacturing with the help of neuro-fuzzy or other approaches by using the fiber, yarn, and fabric constructional data. While applying AI, it is essential to establish a proper linear and nonlinear relationship between the input fiber and yarn parameters the property of the fabric need to be predicted. However, the application of AI can be very expensive for the fabric manufacturers, which can increase the cost of production. AI can also be applied to investigate the comfort properties. While sensorial comfort is considered, fabric can be classified according to their hand value by the application of AI.

### **VIII. Fabric Fault Detection**

A poor quality fabric can result in substandard garments as well as reduces the productivity during garment manufacturing. Any defect in the fabric is passed into the final garment, which can result in the rejection of the garment. Hence, it is essential to check the quality of the fabric before manufacturing the garment. Fabric inspection is performed by skilled workers using lighted tables or equipment [5-6]. This process is rather slow and many times can allow faults to pass to the garment.

Furthermore, the efficiency of the fabric inspectors will be reduced quickly with fatigue. However, the use of AI can perform this task at a faster rate, with much higher accuracy and without fatigue. AI can be applied for fault inspection and grading of the fabrics that are received in a garment industry. The Image of the faults are stored in the system and compared with the captured image. If a difference is observed, the defect is identified and the inspector calculates the fault points.

## **VIII. Conclusion**

In this modern era, AI is being used in many areas to solve various problems with intelligence similar to human being. The application of AI was not widely accepted in the labor-intensive clothing production. However, the global competitive environment and a target to achieve low cost of production are the main reasons for the AI's wider applications in apparel industry starting from material selection and sourcing, through manufacturing till retailing. AI can be used in various processes of textile production such as fiber grading, prediction of yarn properties, detection of fabric faults, and dye recipe prediction. Similarly, AI can be applied in all the stages of garment production such as preproduction, production, and postproduction operations. Developed countries have already started using AI to improve quality of garment, enhanced customer service, and hence increased sales. Much progress is undergoing in AI rapidly and in near future it will become an important tool for the garment manufacturers for enhancing quality, increasing production, lowering operating costs, and exercising in house control over production, leading to quick response and just-in-time concept.

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